valescence. It is easy to see what an immense advantage such institutions for the care of convalescents would be to large industrial institutions. It is equally easy to comprehend the grave difficulties which would attend the conducting of such an institution in civil life. Nevertheless, it is clear that convalescent departments are needed and should be started in connection with our large hospitals; not convalescent homes, but institutions under the charge of active and specially trained physicians; institutions in which every arrangement for the well considered rehabilitation, mental and physical, of the convalescent may be carried out. Here in America the admirable work of General Hospital No. 9, at Lakewood, has shown what symptomatic, physical and mental training may do for the large body of slightly subnormal individuals from whose ranks a considerable percentage of the effort syndrome were derived. The treatment of these cases differs in no essential from that which should be afforded to convalescents in civil life.

If our experience in this war shall help to awaken a new interest in the care of convalescence and shall convince the medical profession and the general public of the importance of suitable physical training in the rehabilitation of the inefficient, a beneficent advance will be made in the art of medicine.

CARDIAC DIAGNOSIS IN THE LIGHT OF EXPERIENCES WITH ARMY PHYSICAL EXAMINATIONS.[1]

By Lewis A. Conner, M.D.,
NEW YORK

During the period of nineteen months which elapsed between the entrance of the United States into the war and the signing of the Armistice, approximately 4,000,000 soldiers, most of them recruits, were subjected to a special physical examination of their circulatory apparatus by officers chosen for their supposed special fitness for this work. No similar examinations upon any such gigantic scale have ever before been attempted.

It seems appropriate at this time to attempt to take stock of what has been accomplished by all this elaborate effort; to inquire whether, in the first place, the direct and immediate benefits to the army have been such as to justify this effort; and, in the second place, whether these examinations have added anything of permanent value to our knowledge of cardiac disorders or of cardiac diagnosis.

---

[1] Read at the meeting of the Association of American Physicians, Atlantic City, June, 1919.

In the present paper no attempt will be made to answer the first query further than to express the belief that the results of the policy of the Surgeon-General of having the cardiovascular examinations of recruits made only by officers of special training and qualifications have more than justified the added expense in personnel, time and money.

As for the question as to whether anything of permanent value has been added to our knowledge of cardiac disorders and of cardiac diagnosis, that can be answered unhesitatingly in the affirmative. There can be no doubt that a real advance has been made in certain phases of cardiac diagnosis, and it is interesting to note that this advance was made not through refinements in laboratory technic or by means of more delicate instruments of precision, but chiefly through the opportunity afforded to examine an immense number of young men, almost all of whom were normal subjects, and to learn the frequency and the extent of normal variations of the physical signs of the heart. This extension of our knowledge of the normal variations I should be inclined to place as the most important gain made in cardiac diagnosis. Next to this should be put the gain in knowledge of the functional disorders of the heart, especially of the so-called irritable heart; and, third, I should place the advance in the diagnosis of the milder forms of organic valvular disease.

Three types of cardiac disease, which in civil life are among the commonest seen by the hospital physician, were conspicuous by their rarity: (1) as was to be expected, the degenerative conditions common to middle and old age; (2) the severe forms and the advanced stages of rheumatic valvular disease, and (3) syphilitic disease of the aorta and heart. The extreme rarity of syphilitic disease deserves in passing a word of emphasis. Among 1,000,000 examinations of drafted recruits there were 11,562 rejections for cardiovascular disorders. Of this number only 20 were rejected, with the diagnosis of thoracic aneurysm. While this figure doubtless does not represent fully the incidence of the disease, and while an occasional aneurysm manifested itself during military service, they were, nevertheless, extraordinarily rare. Much the same may be said concerning the syphilitic type of aortic insufficiency which all the available evidence shows to have been extremely rare, even among the negro troops. Indeed, when one considers the incidence of syphilis among males between the ages of twenty-one and thirty-five years, one might venture, on the basis of the army examinations, to formulate something approaching the dignity of a law, to the effect that *in cases of acquired syphilis the clinical evidences of involvement of the aorta and heart almost never appear before the thirty-fifth year.*

The examiners, as has been said, were selected for their supposed special fitness for this work, as shown either by their past experience or by their response to the special training furnished them by the army schools. Although it would be incorrect to say that all of these several hundred special cardiac examiners possessed exceptional qualifications for the work in hand, it is unquestionable that many of them did. In making up the various groups of examiners, pains were taken to see that in each group at least the officer in charge should be known to be a clinician of experience and special training. Moreover, with the records at hand from the examining boards of each of the fifty or more camps and recruiting stations it was possible to establish averages and controls by which to assess the diagnostic accuracy of the individual boards. Supervision and control were further exercised by occasional visits of inspectors and consultants. In these various ways it was possible, therefore, to keep in touch with the work done in the different camps and to ascertain the difficulties and common errors in diagnosis. Methods of examination and criteria of diagnosis were standardized, insofar as possible, by rules prescribed by the Surgeon-General and issued first in the form of a circular of instructions. These instructions were drafted with consummate skill by the late Major T. C. Janeway, and have formed the basis for all the later rules governing such examinations included in the selective service regulations.

NORMAL VARIATIONS OF PHYSICAL SIGNS. As has been said a realization of the fact that the physical signs of the normal heart are subject to much more frequent and much wider variations than has generally been supposed is to be regarded as one of the important gains for cardiac diagnosis which has come out of the war experiences. These variations affect every type of cardiac physical sign; the position of the apex-beat, as shown by inspection and palpation, the distinctness and character of the cardiac impulse, the area of cardiac dulness, the character and intensity of the heart sounds, all are subject to surprisingly wide variations in perfectly normal individuals. Only a few of the more important of these variations can be discussed here.

The distinctness and the character of the cardiac impulse depend to a very marked degree upon the special conformation of the thorax. If the latter is deep and roomy only a faint and sharply localized apex-beat will be seen and felt. If, however, as often happens, the chest is flat and the space between the bodies of the vertebræ and the sternum very small the heart gives the impression of being flattened up against the chest wall, and there is a marked visible and palpable impulse which may involve all the precordium to the left of the sternum and occasionally even the sternum itself. This together with the associated large area of dulness may readily be misinterpreted as indicating the existence of some cardiac enlargement.

The character and intensity of the heart sounds vary greatly in different individuals under similar conditions and in the same individual under different conditions. Rest, exercise, excitement and change of posture all have their effect in modifying the character of the first heart sound and in changing the intensity of both sounds.

ACCIDENTAL MURMURS. In the modification of the first heart sound the point at which such a changed sound deserves to be called a murmur is one concerning which disagreement is common, but even under the most rigid interpretation of the term the occurrence of such systolic accidental or functional murmurs is surprisingly frequent. When the murmur is located over the base of the heart its true nature is much more likely to be recognized than when it is apical, and yet such apical accidental murmurs are very common. It is not possible to give accurate statistics, but I am convinced, in the light of my own experience, that it would be conservative to say that at least nine-tenths of all apical systolic murmurs in young adults belong to the class of accidental or functional murmurs. Rothschild's figures, which bear upon this point, will be quoted in discussing mitral insufficiency.

These apical systolic accidental murmurs have several features by which they can usually be recognized. First and foremost is their inconstancy. They may be absent during rest and be pronounced after exercise or during excitement. The first sound may be quite clear and normal in the erect posture and have all the characteristics of a murmur in the recumbent position; in the second place they usually show no tendency to be transmitted to the left of the apex; then, too, the murmur is obviously only the modified and changed first sound; it is not something clearly distinct from and additional to the heart sound as is so commonly the case with the murmur of mitral insufficiency. Lastly, such accidental murmurs seem rarely if ever to have the peculiar high-pitched, whizzing or blowing quality usually possessed by those due to mitral insufficiency.

The basal systolic accidental murmurs have much the same characteristics as those at the apex. When heard only to the left of the sternum they are usually readily recognized; but when, as occasionally happens, they are audible over both the pulmonic and the aortic areas, they may be mistaken for the murmur of aortic stenosis.

DIASTOLIC ACCIDENTAL MURMURS. The teaching that accidental murmurs are always systolic in time is in general sound even although the statement is not strictly true. Exceptions to that rule do occur, but they are certainly rare. I have myself seen three undoubted instances of diastolic cardiorespiratory murmurs heard over the base of the heart and bearing a very close resemblance to the murmur of aortic insufficiency. Two of these cases were young officers in whom the murmur had been accidentally discovered, and who after examination by a board had promptly been recommended for discharge because of aortic insufficiency.

THE IRRITABLE HEART OF SOLDIERS. (*The Effort Syndrome, Neurocirculatory Asthenia.*) Notwithstanding the fact that for nearly fifty years almost every text-book of medicine has contained some account of the condition described by Da Costa as "the irritable heart of soldiers," it is nevertheless true that up to the beginning of the war a practical knowledge of that disorder was entirely lacking. It is doubtful if one physician in a thousand had ever ventured to make the diagnosis or had any confidence in his ability to recognize a case if he should see it. It was generally looked upon as an affection peculiar to war conditions and without its counterpart in peace times.

From the very first day of the army heart examinations, however, this neurosis obtruded itself upon the consciousness of the examiners in no uncertain manner. It was far away the commonest disorder encountered and transcended in interest and importance all the other heart affections combined.

One of the most surprising things about the "soldier's heart" was the discovery that in a majority of the cases the symptoms of the disorder were not first manifested under the strain and stress of war but had existed in the recruit for years, often for many years, before the onset of his army career. These cases made up the so-called constitutional type of the disorder.

In another large group of cases the symptoms appeared in previously healthy men after an attack of acute illness, such as pneumonia, dysentery, rheumatic fever or influenza. In most of these "post-infectious" cases there is no reason to suppose that the fact that the patients were soldiers bore any direct relation to the development of the neurosis.

It is clear, therefore, that the affection is far from being peculiar to the conditions of war or to army life. Only a small proportion of the cases have their origin in such special conditions. Obviously, then, the syndrome must exist and must be of fairly frequent occurrence in peace times, notwithstanding the fact that heretofore we have failed so completely to recognize it. With the knowledge of the disorder gained in the war, however, there should be no question of its proper recognition in the future, and the dissemination of this knowledge throughout the profession will constitute one of the most important of the war's contributions to cardiac diagnosis.

All the experience of the army heart examinations has shown the great danger, even with experienced examiners, of mistaking this neurosis for some organic disease of the heart, in contrast to the very rare error of mistaking such organic diseases for the effort syndrome. The "soldiers' hearts" were very apt to be diagnosticated either as myocarditis or as mitral insufficiency or mitral stenosis. It was indeed often difficult to believe that a soldier who, on even moderate exertion, showed such an array of striking symptoms (dyspnea, exhaustion, precordial pain, tremulousness, cyanosis, extreme tachycardia) could be suffering merely from a neurosis. Moreover, certain of the physical signs sometimes bore a close resemblance to those of mitral insufficiency and mitral stenosis. The pronounced and widespread cardiac impulse often suggested cardiac enlargement; the first sound at the apex was usually extremely short and sharp and the second pulmonic sound often very loud; a systolic accidental murmur was sometimes present and the suggestion of a thrill was often given to the palpating hand in the apical region. Because of the rapid heart-rate it was sometimes easy to persuade one's self, erroneously, that this slight thrill was presystolic in time. Thus with such a combination of pronounced symptoms and suggestive physical signs it is not surprising that a good deal of time was needed to educate the great body of medical officers to the true nature of these cases.

Diagnosis of the Mild Forms of Valvular Disease. The progress made during the war in the diagnosis of valvular disease has been chiefly in the direction of recognizing the need for much greater caution in making such diagnoses than was formerly generally believed to be necessary or proper. The recognition of the great frequency of normal variations from the conventional physical signs, including the prevalence of systolic accidental murmurs, as well as the knowledge gained concerning the effort syndrome and the readiness with which it may be mistaken for valvular disease, has led to the conviction that in the past this latter diagnosis was made much more frequently than it deserved to be.

The instances of valvular disease encountered in the army examinations were, practically all of them, of mild type—all the more severe and obvious cases had been eliminated by the examinations of the local draft boards—and it was characteristic of these mild forms of valvular disease that symptoms, as distinguished from physical signs, were entirely lacking. These men, almost without exception, gave a normal cardiac response to exercise, showed the same degree of physical strength and endurance as normal men and could be distinguished from these only by the physical signs of the heart.

It remained throughout the war an amazing paradox that a disorder in which the heart was known to be intrinsically normal should give rise to such pronounced cardiac symptoms, whereas the cases of valvular heart disease were so completely free from symptoms.

Concerning the diagnosis of lesions of the aortic valve there is little to say. These lesions were rare and were usually correctly diagnosticated. Not more than one recruit in every thousand was rejected for disease of the aortic valves, although every such case discovered was rejected. Aortic insufficiency was the one valvular lesion in which the tendency to err was in the direction of making the diagnosis too infrequently. When the diastolic murmur was faint and high pitched it was occasionally overlooked, and this error was, I think, due chiefly to the failure on the part of some examiners to realize that this particular murmur is often better recognized with the naked ear in contact with the chest than through the medium of the stethoscope.

With respect to mitral lesions the examinations demonstrated clearly that the correct diagnosis of the mild forms of these two valvular lesions is by no means always as simple and easy as we have been accustomed to think. They showed, further, that when mistakes in diagnosis are made they are almost invariably in the direction of finding some valvular damage when it does not exist rather than in overlooking a lesion when it is present.

Mitral Insufficiency. The effort syndrome was the condition most frequently mistaken for mitral insufficiency, as indeed it was also for mitral stenosis. The rapid and violent heart action and pronounced cardiac impulse frequently gave the impression of cardiac hypertrophy; if, in addition, there was to be heard an apical accidental murmur the resemblance to mitral insufficiency might be close and, to the uninitiated, the diagnosis would seem to be confirmed by the pronounced subjective symptoms of precordial pain, dyspnea, palpitation, etc. With increasing experience in the recognition of the effort syndrome its confusion with mitral insufficiency became less and less frequent, for the two conditions bear little real resemblance to each other. The tachycardia, which is so constant and marked a feature of the "soldiers' heart," is no part of the clinical picture of mitral leakage, and, as has been said, the pronounced subjective symptoms were characteristic of the neurosis and were altogether lacking in the valvular cases.

The question has been much discussed of late as to whether one is ever justified in making a positive diagnosis of mitral insufficiency on the existence of an apical murmur alone, and in the absence of signs of hypertrophy and of a history of definite attacks of rheumatic fever, even though the murmur have those special characteristics of transmission and quality which are supposed to belong to that disease. My own attitude toward this question has been modified a good deal by my army experiences and without venturing to be dogmatic upon the subject I am inclined to believe that one will make fewest mistakes in the diagnosis of mitral regurgitation by adhering to the rule of never venturing a diagnosis on the presence of a murmur alone, no matter how characteristic it may seem to be. It is certain that if this rule were generally followed uncomplicated mitral insufficiency would take its place among the less frequent forms of valvular disease, as I believe it deserves to do. In this connection the statistics of Rothschild[2] are very instructive. Assuming

[2] Jour. Am. Med. Assn., February 1, 1919, lxxii, 327.

the chief criteria for the diagnosis of mitral regurgitation to be (1) cardiac hypertrophy, (2) an apical systolic murmur and (3) a definite history of rheumatic fever, and arguing that the presence together of (1) and (2), or of (2) and (3), should at least raise a grave suspicion of valvular disease, he analyzes the records of the examinations of 10,000 recruits, accepted for limited service, with these points in mind. Among this number there were 870 cases with recorded systolic murmurs, of which only 33, or 3.8 per cent. fulfilled the above requirements for the diagnosis of mitral insufficiency.

MITRAL STENOSIS. The physical signs of mitral stenosis are usually so distinctive and striking that it may be hard to understand why much difficulty in its diagnosis should have occurred. As a matter of fact, however, there was constantly a tendency to mistake cases of "soldiers' heart" for this form of valvular disease. This tendency was much more pronounced at first than later on, but even when the clinical picture of the effort syndrome had become a familiar and well understood one there were still occasional cases in which the differential diagnosis between this neurosis and mitral stenosis was very difficult. In the former condition the heartbeats are not only very rapid but are usually quick and forcible in character; the apical impulse often is sharp and tapping, the first sound short and sharp and occasionally a suggestion of a thrill may be felt which, because of the rapid heart rate, it is difficult to time accurately. All these signs bear resemblance to those of mitral stenosis. Occasionally, too, the first sound is impure or reduplicated, and it is easy to fancy that this is really a very short presystolic murmur.

These physical signs are often very much like those of the heart in exophthalmic goiter, which, as is well known, may closely simulate the signs of mitral stenosis. There are, however, certain differential points which will usually suffice to clear up the uncertainty between the effort syndrome and mitral stenosis. In the first place a rapid heart rate *during rest* is very exceptional in the mild forms of mitral stenosis under consideration. Usually the rate is quite normal, although it may become rapid upon even slight exertion or under excitement. On the other hand anything approaching a normal heart-rate, even during rest, is very unusual in the "soldier's heart."

In the next place a distinct and unmistakable presystolic murmur is so constant a sign of these mild cases of stenosis that this diagnosis is not justified, I think, unless the murmur is heard. It may be audible only in certain postures or only after some exertion, but is rarely, if ever, lacking entirely. No matter how suggestive the other physical signs may be, the diagnosis, in my judgment, cannot safely be made in the absence of an unmistakable presystolic murmur.[3]

---

[3] This view accords with that expressed by Lewis in his recent admirable monograph on the Soldier's Heart.

Finally, in the mild grades of valvular disease there are lacking all the pronounced symptoms of dyspnea on exertion, faintness, precordial pain, palpitation, tremulousness, cyanosis and sweating, which are such a characteristic part of the clinical picture of the effort syndrome. Two procedures have been suggested recently as aids in clearing up the diagnosis in doubtful cases of mitral stenosis. Morison[4] has found that the inhalation of nitrite of amyl will sometimes cause a doubtful murmur either to become more distinct or to disappear. Rothschild[5] has sought to bring out the murmur in doubtful cases with very rapid heart action by slowing the heart by the use of ocular pupillary pressure.

SUMMARY. The examination of the cardiovascular apparatus of immense numbers of soldiers by specially qualified medical officers has resulted in a distinct gain to our knowledge of certain phases of cardiac diagnosis. This gain has been chiefly in three directions: A better appreciation of the extent and the frequency of normal variations from the conventional physical signs of the heart; the recognition of the importance and frequency of the syndrome known as the irritable heart of soldiers or the effort syndrome, and an increased accuracy in the diagnosis of the mild forms of valvular disease, especially of mitral insufficiency and mitral stenosis.

Variations from the conventional physical signs of the heart are extremely common in normal individuals and affect every type of physical sign. Of these the systolic accidental or functional murmurs heard at the apex and in the pulmonic area are the most important and the most likely to lead to errors in diagnosis. It is believed that fully nine-tenths of all apical systolic murmurs belong to this class of accidental or functional murmurs.

The neurosis known as the irritable heart of soldiers has been the most frequent, and much the most important heart disorder encountered during the war. Because of the pronounced cardiac symptoms associated with it and the suggestive physical signs it is very likely to be mistaken for some organic disease of the heart, especially for mitral insufficiency or mitral stenosis. The knowledge gained of this disorder during the war indicates that only a minority of the cases have their origin in conditions peculiar to war and that the condition must have existed, and been far from rare, in civil life in spite of our failure to recognize it.

The army examinations have demonstrated that the mild grades of valvular disease, which were almost the only types encountered, show a cardiac reserve power well within normal limits and are remarkably free from subjective symptoms. In this respect they offer a striking contrast to the effort syndrome in which such symptoms are usually pronounced.

---

[4] British Med. Jour., April 20, 1918, i, 452.

[5] Jour. Am. Med. Assn., March, 1919, lxxii, 652.

The inclination to diagnosticate mitral leakage upon the presence of an apical systolic murmur alone is to be resisted. In the absence of evidences of cardiac hypertrophy or of a history of definite attacks of rheumatic fever it is doubtful if one is justified in making the diagnosis even though the murmur have those features of transmission and quality which are supposed to be characteristic of that disease.

In view of the danger of mistaking cases of soldiers' heart for those of mitral stenosis the latter diagnosis should not be made unless an unmistakable and characteristic presystolic murmur be present.

The extraordinary rarity of cases of syphilitic disease of the aorta and heart among the men examined seems to indicate that the clinical manifestations of syphilis in the aorta and heart almost never appear before the thirty-fifth year.

REPORT OF A CASE OF RUPTURE OF AN AORTIC ANEURYSM INTO THE LEFT INNOMINATE VEIN.[1]

By James B. Herrick, M.D.,
CHICAGO.

This case is reported simply in order to place on record another instance of rupture of an aneurysm of the aorta into the superior vena cava. I speak of rupture into the superior vena cava, though actually the rupture was into the left innominate vein, less than 1 cm. from the cava, the opening of communication being 1.5 cm. in diameter. The autopsy (Dr. B. A. Raulston) further showed marked old and active aortitis, typically luetic. The aneurysm had its origin 4 cm. above the aortic valves, the rounded sac, some 7 cm. in diameter, projecting in such a way as to produce a pressure constriction of the superior vena cava, especially marked close to the heart where it would clearly almost completely shut off circulation in the cava and block the azygos vein. The innominate and azygos veins were "hugely distended."

The diagnosis made after an examination of the patient who came under my care in the Presbyterian Hospital January 12, 1919, was aortic aneurysm, with rupture into the superior vena cava. While I had never before seen a case of this sort, I remembered having heard Dr. Stengel make a report of one before this Association in 1900. On reading Dr. Stengel's[2] article one was referred to the fuller discussion of the subject by Pepper and Griffith[3] in their

---

[1] Read at the meeting of the Association of American Physicians, Atlantic City, June 17, 1919.

[2] Tr. Assn. Am. Phys., 1900, xv.

[3] Ibid., 1890, v.